CLAIMS

1. A polishing pad for mechanical or chemical-mechanical planarization of microelectronic-device substrate assemblies on a stationary table having a first dimension extending along a pad travel path and an illumination site from which a light beam can emanate from the table, the pad comprising:

a planarizing medium having a planarizing surface configured to engage a substrate assembly and a backside to face towards the table, the planarizing medium being moveable over the table along the pad travel path to place a fresh portion of the planarizing surface at one side of a planarizing zone on the table and to remove a worn portion of the planarizing surface from an opposite side of the planarizing zone; and

an optical pass-through system in the planarizing medium, the optical pass-through system having a plurality of view sites extending along a length of the planarizing medium in a direction generally parallel to the pad travel path, each view site providing an optically transmissive path through the pad.

2. The polishing pad of claim 1, further comprising:

an optically transmissive backing sheet having a top surface and a under surface, the planarizing medium being disposed on the top surface;

a backing pad attached to the under surface of the backing sheet; and

wherein the optical pass-through system comprises at least one opening in the planarizing medium alignable with the illumination site on the table and at least one orifice in the backing pad at least partially aligned with the opening in the planarizing medium.

3. The polishing pad of claim 1, further comprising:

an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface;

a backing pad attached to the under surface of the backing sheet; and

wherein the optical pass-through system comprises an elongated slot extending through the planarizing medium along the length of the planarizing medium in the direction generally parallel to the pad travel path and alignable with the illumination site to divide the planarizing medium into a first section and a second section, and the optical pass-through system further comprises a plurality of openings through the backing pad and arranged in a line aligned with the elongated slot through the planarizing medium.

4. The polishing pad of claim 1, further comprising:

an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface;

a backing pad attached to the under surface of the backing sheet; and

wherein the optical pass-through system comprises a first elongated slot extending through the planarizing medium along the length of the planarizing medium in the direction generally parallel to the pad travel path and alignable with the illumination site to divide the planarizing medium into a first section and a second section, and the optical pass-through system further comprises a second elongated slot through the backing pad and aligned with the first elongated slot through the planarizing medium.

5. The polishing pad of claim 1, further comprising:

an optically transmissive backing sheet having a top surface, an under surface, and a flat-topped ridge extending in the direction generally parallel to the pad travel path and alignable with the illumination site;

a backing pad attached to the under surface of the backing sheet;

wherein the planarizing medium comprises a first section of abrasive material disposed on the top surface of the backing sheet on one side of the ridge and a second section of abrasive material disposed on the top surface of the backing sheet on the other side of the ridge; and

wherein the optical pass-through system comprises a first elongated slot extending through the planarizing medium between the first and second sections of abrasive material, the ridge being positioned in the elongated slot, and the optical pass-through system further comprises a second elongated slot through the backing pad and aligned with the first elongated slot through the planarizing medium.

6. The polishing pad of claim 1 wherein the optical pass-through system comprises an elongated slot through the planarizing medium that extends along the length of the planarizing medium in the direction generally parallel to the pad travel path, the slot dividing the planarizing medium into a first section and a second section.

7. The polishing pad of claim 1 wherein the optical pass-through system comprises a plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, each hole being separately alignable with the illumination site according to the portion of the pad over the illumination site.

8. The polishing pad of claim 1, further comprising an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing sheet, and wherein the optical pass-through system comprises an elongated slot through the planarizing medium that extends along the length of the planarizing medium in the direction generally parallel to the pad travel path, the slot dividing the planarizing medium into a first section and a second section.

9. The polishing pad of claim 1, further comprising an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing sheet, and wherein the optical pass-through system comprises a plurality of holes through the planarizing

medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, each hole defining a separate view site.

10. The polishing pad of claim 1, further comprising a backing pad having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing pad, wherein the optical pass-through system comprises a first elongated slot through the planarizing medium that extends along the length of the planarizing medium in the direction generally parallel to the pad travel path to divide the planarizing medium into a first section and a second section, and the optical pass-through system further comprises a second elongated slot through the backing pad aligned with the first slot through the planarizing medium.

11. The polishing pad of claim 1, further comprising a backing pad having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing pad, wherein the optical pass-through system comprises a first plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, and the optical pass-through system further comprises a second plurality of holes in which each hole of the second plurality of holes is aligned with a corresponding hole of the first plurality of holes.

12. The polishing pad of claim 1, further comprising an optically transmissive backing sheet having a top surface and an under surface, and wherein the planarizing medium is an abrasive layer having a resin and abrasive particles distributed in the resin, the planarizing medium being disposed on the top surface of the backing sheet.

13. The polishing pad of claim 12 wherein the optical pass-through system comprises an elongated slot through the planarizing medium that extends along

the length of the planarizing medium in the direction generally parallel to the pad travel path to divide the planarizing medium into a first section and a second section.

14. The polishing pad of claim 12 wherein the optical pass-through system comprises a plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, each hole being alignable with the illumination site as the pad incrementally moves over the table.

15. A polishing pad for chemical-mechanical planarization of microelectronic-device substrate assemblies, comprising:

an optically transmissive backing sheet having a top surface and an under surface;

a backing pad attached to the under surface of the backing sheet, the backing pad having at least one viewing port; and

a planarizing medium disposed on the top surface of the backing sheet, the planarizing medium having at least one viewing port at least partially aligned with the viewing port in the backing pad.

16. The polishing pad of claim 15 wherein:

the at least one viewing port in the planarizing medium comprises a first elongated slot through the planarizing medium that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium, the first slot dividing the planarizing medium into a first section and a second section; and

the at least one viewing port in the backing pad comprises a second elongated slot through the backing pad that extends in the direction generally parallel to the pad travel path in alignment with the first slot.

17. The polishing pad of claim 15 wherein:

the at least one viewing port in the planarizing medium comprises an elongated slot through the planarizing medium that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium, the slot dividing the planarizing medium into a first section and a second section; and

the at least one viewing port in the backing pad comprises a plurality of orifices in alignment with the slot.

18. The polishing pad of claim 15 wherein:

the at least one viewing port in the planarizing medium comprises a plurality of holes through the planarizing medium, the holes being arranged in a line that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium; and

the at least one viewing port in the backing pad comprises a slot through the backing pad that extends in the direction generally parallel to the pad travel path in alignment with the plurality of holes.

19. The polishing pad of claim 15 wherein:

the at least one viewing port in the planarizing medium comprises a plurality of holes through the planarizing medium, the holes being arranged in a line that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium; and

the at least one viewing port in the backing pad comprises a plurality of orifices through the backing pad, each orifice in the backing pad being aligned with a corresponding hole through the planarizing medium.

20. A polishing pad for chemical-mechanical planarization of microelectronic-device substrate assemblies, comprising:

an optically transmissive backing sheet having a top surface and an under surface; and

a planarizing medium disposed on the top surface of the backing sheet, the planarizing medium having at least one viewing port configured to be aligned with the illumination site in the table.

21. The polishing pad of claim 20 wherein the viewing port in the planarizing medium comprises an elongated slot through the planarizing medium that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium, the slot dividing the planarizing medium into a first section and a second section.

22. The polishing pad of claim 20 wherein:

the viewing port in the planarizing medium comprises an elongated slot through the planarizing medium that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium, the slot dividing the planarizing medium into a first section and a second section; and

the backing sheet includes a flat-top ridge projecting from the top surface and positioned in the slot.

23. The polishing pad of claim 20 wherein the viewing port in the planarizing medium comprises a plurality of holes through the planarizing medium, the holes being arranged in a line that extends in a direction generally parallel to the pad travel path along a length of the planarizing medium.

24. The polishing pad of claim 20, further comprising:

a backing pad attached to the under surface of the backing sheet, the backing pad having a slot through the backing pad that extends in the direction generally parallel to the pad travel path in alignment with the viewing port in the planarizing medium.

25. A planarizing machine for mechanical or chemical-mechanical planarization of microelectronic-device substrate assemblies, comprising:

a table including a support surface having a first dimension extending along a pad travel path, a second dimension transverse to the first dimension and a planarizing at zone at least within the first and second dimensions;

a light source under to the table at an illumination site from which a light beam can emanate from the support surface of the table;

a polishing pad moveably coupled to the support surface of the table, the pad including a planarizing medium and an optical pass-through system, wherein the planarizing medium includes a planarizing surface configured to engage a substrate assembly and a backside to face towards the table, and wherein the optical pass-through system includes a plurality of view sites along a length of the pad in a direction generally parallel to the pad travel path, each view site providing an optically transmissive path through the pad;

a pad advancing mechanism engaged with the pad, the advancing mechanism being configured to move the pad over the table along the pad travel path to place a fresh portion of the planarizing surface at one side of a planarizing zone on the table and to remove a worn portion of the planarizing surface from an opposite side of the planarizing zone; and

a carrier assembly having a head for holding a substrate assembly and a drive assembly connected to the head to move the substrate assembly with respect to the polishing pad.

26. The polishing pad of claim 25, further comprising:

an optically transmissive backing sheet having a top surface and a under surface, the planarizing medium being disposed on the top surface;

a backing pad attached to the under surface of the backing sheet; and

wherein the optical pass-through system comprises at least one opening in the planarizing medium alignable with the illumination site on the table and at least

one orifice in the backing pad at least partially aligned with the opening in the planarizing medium.

27. The polishing pad of claim 25, further comprising:

an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface;

a backing pad attached to the under surface of the backing sheet; and

wherein the optical pass-through system comprises an elongated slot extending through the planarizing medium along the length of the planarizing medium in the direction generally parallel to the pad travel path and alignable with the illumination site to divide the planarizing medium into a first section and a second section, and the optical pass-through system further comprises a plurality of openings through the backing pad and arranged in a line aligned with the elongated slot through the planarizing medium.

28. The polishing pad of claim 25, further comprising:

an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface;

a backing pad attached to the under surface of the backing sheet; and

wherein the optical pass-through system comprises a first elongated slot extending through the planarizing medium along the length of the planarizing medium in the direction generally parallel to the pad travel path and alignable with the illumination site to divide the planarizing medium into a first section and a second section, and the optical pass-through system further comprises a second elongated slot through the backing pad and aligned with the first elongated slot through the planarizing medium.

29. The polishing pad of claim 25, further comprising:

an optically transmissive backing sheet having a top surface, an under surface, and a flat-topped ridge extending in the direction generally parallel to the pad travel path and alignable with the illumination site;

a backing pad attached to the under surface of the backing sheet;

wherein the planarizing medium comprises a first section of abrasive material disposed on the top surface of the backing sheet on one side of the ridge and a second section of abrasive material disposed on the top surface of the backing sheet on the other side of the ridge; and

wherein the optical pass-through system comprises a first elongated slot extending through the planarizing medium between the first and second sections of abrasive material, the ridge being positioned in the elongated slot, and the optical pass-through system further comprises a second elongated slot through the backing pad and aligned with the first elongated slot through the planarizing medium.

30. The polishing pad of claim 25 wherein the optical pass-through system comprises an elongated slot through the planarizing medium that extends along the length of the planarizing medium in the direction generally parallel to the pad travel path, the slot dividing the planarizing medium into a first section and a second section.

31. The polishing pad of claim 25 wherein the optical pass-through system comprises a plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, each hole being separately alignable with the illumination site according to the portion of the pad over the illumination site.

32. The polishing pad of claim 25, further comprising an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing sheet, and wherein the

optical pass-through system comprises an elongated slot through the planarizing medium that extends along the length of the planarizing medium in the direction generally parallel to the pad travel path, the slot dividing the planarizing medium into a first section and a second section.

33. The polishing pad of claim 25, further comprising an optically transmissive backing sheet having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing sheet, and wherein the optical pass-through system comprises a plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, each hole defining a separate view site.

34. The polishing pad of claim 25, further comprising a backing pad having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing pad, wherein the optical pass-through system comprises a first elongated slot through the planarizing medium that extends along the length of the planarizing medium in the direction generally parallel to the pad travel path to divide the planarizing medium into a first section and a second section, and the pass-through system further comprises a second elongated slot through the backing pad aligned with the first slot through the planarizing medium.

35. The polishing pad of claim 17, further comprising a backing pad having a top surface and an under surface, the planarizing medium being disposed on the top surface of the backing pad, wherein the optical pass-through system comprises a first plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, and the optical pass-through system further comprises a second plurality of holes in which each hole of the second plurality of holes is aligned with a corresponding hole of the first plurality of holes.

36. The polishing pad of claim 25, further comprising an optically transmissive backing sheet having a top surface and an under surface, and wherein the planarizing medium is an abrasive layer having a resin and abrasive particles distributed in the resin, the planarizing medium being disposed on the top surface of the backing sheet.

37. The polishing pad of claim 36 wherein the optical pass-through system comprises an elongated slot through the planarizing medium and extending along the length of the planarizing medium in the direction generally parallel to the pad travel path to divide the planarizing medium into a first section and a second section.

38. The polishing pad of claim 36 wherein the optical pass-through system comprises a plurality of holes through the planarizing medium arranged in a line along the length of the planarizing medium in the direction generally parallel to the pad travel path, each hole being alignable with the illumination site as the pad incrementally moves over the table.

39. A planarizing machine for mechanical or chemical-mechanical planarization of microelectronic-device substrate assemblies, comprising:

a table including a support surface having a first dimension extending along a pad travel path, a second dimension transverse to the first dimension and a planarizing at zone at least within the first and second dimensions;

a light source attached to the table at an illumination site from which a light beam can emanate from the support surface of the table;

a polishing pad moveably coupled to the support surface of the table, the pad including an optically transmissive backing sheet having an under surface facing the table and a top surface, the pad also including a planarizing medium disposed on the top surface of the backing sheet, and the planarizing medium having at least one opening configured to be aligned with the illumination site in the table;

a pad advancing mechanism engaged with the pad, the advancing mechanism configured to move the pad over the table along the pad travel path to place a fresh portion of the planarizing surface at one end of a planarizing zone on the table and to remove a worn portion of the planarizing surface from an opposite end of the planarizing zone; and

a carrier assembly having a head for holding a substrate assembly and a drive assembly connected to the head to move the substrate assembly with respect to the polishing pad.

40. A method of endpointing mechanical or chemical-mechanical planarization processing of microelectronic-device substrate assemblies, comprising:

initially passing a light beam from an illumination site in a table through a first optically transmissive view site in a polishing pad to at least periodically impinge a first substrate assembly with the light beam and optically sense a surface condition of the first substrate assembly;

advancing the polishing pad relative to the table and the illumination site after planarizing the first substrate assembly; and

subsequently passing a light beam from the illumination site in the table through a second optically transmissive view site in the polishing pad to at least periodically impinge a second substrate assembly with the light beam and optically sense a surface condition of the second substrate assembly.

41. The method of claim 40 wherein:

the polishing pad comprises a planarizing medium having an elongated slot that extends in a direction generally parallel to the pad travel path;

initially passing the light beam through the first view site comprises passing the light beam through a first area of the elongated slot; and

subsequently passing the light beam through the second view site comprises passing the light beam through a second area of the elongated slot spaced apart from the first area.

42. The method of claim 40 wherein:

the polishing pad comprises a planarizing medium having a plurality of openings arranged in a line that extends in a direction generally parallel to the pad travel path;

initially passing the light beam through the first view site comprises passing the light beam through a first discrete opening in the planarizing medium; and

subsequently passing the light beam through the second view site comprises passing the light beam through a second discrete opening in the planarizing medium spaced apart from the first opening.

43. A method for planarizing microelectronic-device substrate assemblies, comprising:

removing material from a first substrate assembly by pressing the first substrate assembly against a planarizing surface of a polishing pad and moving the first substrate assembly with respect to the polishing pad;

initially passing a light beam from an illumination site in the table through an optically transmissive view site in the polishing pad to at least periodically impinge the first substrate assembly with the light beam and optically sense a surface condition of the first substrate assembly until the sensed surface condition indicates that the first substrate assembly has reached a desired endpoint;

advancing the polishing pad relative to the table and the illumination site after planarizing the first substrate assembly;

removing material from a second substrate assembly by pressing the second substrate assembly against the planarizing surface of the polishing pad and moving the second substrate assembly with respect to the polishing pad; and

subsequently passing a light beam from the illumination site in the table through another optically transmissive view site in the polishing pad to at least periodically impinge the second substrate assembly with the light beam and optically

sense a surface condition of the second substrate assembly until the sensed surface condition indicates that the second substrate assembly has reached a desired endpoint.

44. The method of claim 43 wherein:

the polishing pad comprises a planarizing medium having an elongated slot that extends in a direction generally parallel to the pad travel path;

initially passing the light beam through the first view site comprises passing the light beam through a first area of the elongated slot; and

subsequently passing the light beam through the second view site comprises passing the light beam through a second area of the elongated slot spaced apart from the first area.

45. The method of claim 43 wherein:

the polishing pad comprises a planarizing medium having a plurality of openings arranged in a line that extends in a direction generally parallel to the pad travel path;

initially passing the light beam through the first view site comprises passing the light beam through a first discrete opening in the planarizing medium; and

subsequently passing the light beam through the second view site comprises passing the light beam through a second discrete opening in the planarizing medium spaced apart from the first opening.

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